Fermilab

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OPERATIONAL DATA FOR VAPOR COOLED E/S LEADS

A. D. McInturff

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This note describes the test procedure used to obtain the operating characteristics of the vapor cooled "AMI" 5kA power leads that are employed in the Tevatron. There exists in the Cyber, a public access file in my area, 94810, with a summary of that data for all the leads tested to date, by either serial number or the TSH spool serial number.

A lead pair is mounted into a fixture in a vertical dewar which had a heater immersed in the liquid helium bath. The warm end gas connection of the leads in this pair would then be individually connected to a copper coil which had a heater tape wrapped around it to maintain the exit helium gas at room temperature. The exiting gas flow was then measured and adjusted by a standard gauge. The test rig also had the ability to monitor the gas temperatures at the top of the lead as well as it's exit of the copper coil. The lead pair were inter-connected by a 5T, 5kA, 4.2K rated superconducting cable whose voltage was fed to a standard E/S safety circuit (which would trip off the power supply if the cable voltage exceeded a few millivolts). The other voltage signals that were monitored were those of the leads themselves. Finally, the current was measured and all of these were recorded continuously as a function of time. The heater in the helium bath was used to pressurize the test dewar. In about 10% of the tests, the temperature of the cold flag and the 3/4 length position on the lead were measured as well.

When testing the leads in the spools during the SPTF runs, the pressure in the single phase was high enough not to require any additional pressurizing methods, therefore, no heater was necessary. During the SPTF runs, the busses were shorted together with a superconducting cable link. The sequence was to establish a gas flow rate through the leads, (~5 liters of liquid helium equiv/hour), and ramp the current to 4.5kA or the current of interest, i.e., 3.5 kiloamperes or 6 kiloamperes and hold. As the voltage across the leads rose, it was recorded as a function of time. The lead was considered stable if the rate of voltage change was $\leq$ 1MV/MIN. The power supply was also shut off if the voltage drop across a given lead was greater than 100mv/lead. The current is reduced to zero, then the flow rate is increased and the process is repeated.

This data has been summarized and archived in a data file in area, 94810, called Leads. There is an index in the top of the file explaining the numbers and how to read them.

To obtain the data file in your output box, just log into the Cyber and give the following commands:

Get, Leads/UN = 94810

Route, Leads/DC = LP

A sample printout of the file is in Appendix II.

APPENDIX II

WORD NUMBER	
1	SERIAL NUMBER OF LEAD
2	DATE OF TEST
3	RECOMMENDED FLOW (LITERS PER HOUR)
4	CURRENT (KILOAMPS,DC)
5	FLOW RATE (LITERS PER HOUR)
6	VOLTAGE AT CURRENT (MILLIVOLTS)
7	TIME TO REACH 1 MV/MIN (MINUTES)
8	VOLTAGE AT 1 MV/MIN
9	EXITING GAS TEMPERATURE

IF 1 MV/MIN WASN'T REACHED THE NEXT 3 WORDS
TELL YOU ABOUT THE LATEST AVAILABLE RATE:

10	VOLTAGE
11	VOLTAGE CHANGE PER MINUTE
12	TIME AFTER START OF RUN THAT 10 AND 11 ARE READ (MINUTES)

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COMMENTS:

TSH345 SPECIAL POWER LEAD TEST

LEAD STEADY STATE 7 L/H @ 50.9 & 44.9 MV EACH.

SHUT OFF GAS FLOW
12.2 SECONDS LATER SC BUSS TRIPPED OFF
WITH THE LEAD VOLTAGE OF 66 & 67 MV EACH.

1	1		830531	8.0	3.5	7.0	24			55	1.5	16
						7.5	24	5.5	40			
						8.0	24	4.5	32			
						9.0	16	3.5	24			
						10.0	16	3.0	20			
						11.0	16	2.0	17			

				4.5	8.0	30				80	31	2.1
					9.0	27				65	17	3.2
					10.0	25	2.8	72	-11			
	1	830614	10.5	4.5	10.0	28	8.0	74	-1			
				6.0	9.0	27				80	3.6	4.5
					11.0	25	4.0	60	-24			
	2	830614	10.5	4.5	10.0	26	9.0	37	-14			
				6.0	9.0	27				82	6	4.5
					11.0	26	4.0	32	-29			
	3	830613	9.5	6.0	8.0	42				82	8	4.4
					9.0	31	4.0	52	0			
					9.5	30	7.0	48				
					10.0	28	8.0	48				
	4	830613	9.5	6.0	8.0	40				66	4	4.4
					9.0	32	4.0	52	-9			
					9.5	32	7.5	50				
					10.0	28	7.5	44				
	5	830804	9.5	6.0	8.0	37				70	3	6
					9.0	33	10.8	66	35			
					10.0	30	9.0	49				
	6	830531	8.5	3.5	7.0	24				78	6	13.5
					8.0	24	4.2	34				
					9.0	17	6.1	28				
					10.0	17	2.5	22				
					11.0	17	2.0	19				
				4.5	8.0	32				81	35	1.8
					9.0	28				80	28	2.8
					10.0	27				50	2	5
	6	830707	9.5	6.0	7.0	42				74	10	4
					8.0	32				58	1.5	8
					9.0	31	2.5	40	-60			
					9.5	27	3.5	35				
					10.0	26	2.5	32				
	6	830804	9.5	6.0	8.0	38				75	4	6
					9.0	34	10.8	68	27			
					10.0	31	9.0	50				
	7	830707	8.5	6.0	7.0	33				48	3	4
					8.0	27	6.5	37	0			
					9.0	25	2.5	30				
					9.5	23	3.5	27				
					10.0	22	2.5	24				
1	8	830723	9.5	6.0	9.0	33	15.0	75	33			
					9.5	32	6.0	54				
					10.0	31	4.5	43				
	9	830722	8.5	6.0	7.0	36				64	4	4.5
					8.0	34	6.0	54	14			
					9.0	31	5.0	45				
					10.0	30	4.0	40				
	10	830722	8.5	6.0	7.0	34				54	3	4.5
					8.0	33	6.0	43	-1			